ASCENT Supply Chain Tools and Projects

Michael Wolcott, Kristin Brandt, Dane Camenzind, Lina Martinez
Washington State University

Burt English, Edward Yu
University of Tennessee

Scott Turn
University of Hawaii

Nathan Brown, FAA Program Manager
Anna Oldani, FAA Program Manager
ASCENT Team

Lead Universities:
Washington State University (WSU)
Massachusetts Institute of Technology (MIT)

Core Universities:
Boston University (BU)
Georgia Institute of Technology (Ga Tech)
Missouri University of Science and Technology (MS&T)
Oregon State University (OSU)
Pennsylvania State University (PSU)
Purdue University (PU)
Stanford University (SU)
University of Dayton (UD)
University of Hawaii (UH)
University of Illinois at Urbana-Champaign (UIUC)
University of North Carolina at Chapel Hill (UNC)
University of Pennsylvania (UPenn)
University of Tennessee (UT)
University of Washington (UW)

Advisory Committee - 58 organizations:
5 airports
4 airlines
7 NGO/advocacy
9 aviation manufacturers
11 feedstock/fuel manufacturers
22 R&D, service to aviation sector
ASCENT Focus Areas

Alternative Jet Fuels

Feedstock Development, Processing and Conversion

Regional Supply Chain Design and Analysis

Environmental Benefits Analysis

Aircraft Component Deterioration and Wear

Fuel Performance Testing
Leveraging UTenn Suite of Tools

POLYSYS
Dynamic partial equilibrium displacement model of US agriculture and forestry sectors

BioFLAME
Optimization model that determines the least-cost locations of biofuel facilities supplying aviation fuel to airports

ForSEAM
Estimates forest and production over time (traditional forest products & products to meet biomass feedstock demands)

IMPLAN
Input-output model used to determine the economic impacts that would occur if a biorefinery located in a region

BeSTA
Programming model that simulates LCA feedstock supply chain activities at the biorefinery level

Additional Models
- EPIC
- DAYCENT
- SPARROW
ASCENT Supply Chain Tool Integration

CONFIGURATION

DESIGN

ANALYSIS

- TEAs
- CAPEX/OPEX
- MSP
- LOGISTICS OPTIMIZATION
  - FEEDSTOCK COLLECTION COSTS
  - FACILITY COSTS
- SD MODEL
  - SUPPLY CHAIN CONFIGURATION
  - MODEL SCENARIOS
  - THROUGHPUT OVER TIME
Harmonized TEAs
Resource Siting Models

Buffer Layers
- Highways
- Railways
- Natural Gas Pipelines

Cost Layers
- Incoming Feedstock Cost
- Electricity Cost
- Natural Gas Cost

Variable Costs $/MT
- 6
- 28
- 50
- >50
Optimization

Scenario
Structure: IBR
Jet Fuel Cost: 5.70 $/gal

Nodes
- Airport
- IBR/Upgrading Refinery

Links
- From Feedstock
- To Airport

Unpublished data, please do not replicate, share or cite.
Publication in progress.
Supply Chain Configuration – Commodity + Services

Maximize Revenues

*Incentives

Minimize Costs
ASCENT Regional Projects
Pacific Northwest Regional Efforts

- Washington State Aviation Biofuels Workgroup
  - Since 2015
  - WA Clean Fuels Standard

- Port of Seattle – Regional Assessment
  - ASCENT Supply Chain Tools
  - Lipids/HEFA
  - MSW/GFT
  - Forest Residual/GFT/ATJ
50% Pine / 50% Switchgrass

- The two feedstock together can serve nine biorefineries
- A total of 9.1 million tons of feedstock are needed
- Nearly 611 thousand acres of lands are used for feedstock
- The average feedstock cost is around $61.7 per dry short ton (≈$68 per dry MT)
Nashville SAF from Pennycress

• Bio-oil feedstock costs from pennycress to feed a HEFA biorefinery to supply Nashville, Tennessee International Airport

• Three crush facilities are required

• The economic analysis shows that the pennycress oil could be available at the range from $0.80 to 1.09 per kg depending on whether the crush facility paid $0.081 to $0.108 per pound.
Central Appalachian SAF from Hardwood

- Quantify and characterize woody biomass feedstock and identify optimal SAF and coproduct supply chains in the Central Appalachian Region (CAR)
- Three biorefinerries could be located in the CAR to supply 545,000 dry short tons
- Total feedstock cost delivered to biorefineries is around $105 million
Pongamia (*Milletia pinnata*)

No competing land use

Irrigated land and current ag land use removed

Eco Crop Model

Legend

Suitability

- 1
- 0.75 and 1
- 0.5 and 0.75
- 0 to 0.5
- Unsuitable
C&D Waste Regional Project

Material Processing

C&D Waste mined from landfill or truck intake

~50 kg feedstock sample

C&D Sampling

FactSage™ Model Prediction

O₂ gasification

As, Pb, Zn, S, Mn, Cr, Cu

Log10 of [Concentration] (ppm)

Element

FAA CENTER OF EXCELLENCE FOR ALTERNATIVE JET FUELS & ENVIRONMENT
QUESTIONS